



The product described in this document has not been fully tested to ensure conformance to the requirements outlined below. Therefore, TE Connectivity (TE) makes no representation or warranty, express or implied, that the product will comply with these requirements. Further, TE may change these requirements based on the results of additional testing and evaluation. Contact TE Engineering for further details.

### 090 MLC Series

## 1. SCOPE

### 1.1. Content

This specification covers the requirements for product performance, test methods and quality assurance provisions of 090 MLC Series.

### 1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

### 1.3. Qualification Test Results

Successful qualification testing on the subject product line has not been completed. The Qualification Test Report number will be issued upon successful qualification testing.

## 2. APPLICABLE DOCUMENTS AND FORMS

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

### 2.1. TE Documents

- 368175 : Customer Drawing (090 MLC 8P CAP HSG)
- 368176 : Customer Drawing (090 MLC 8P PLUG HSG)
- 368178 : Customer Drawing (090 MLC 10P PLUG HSG)
- 368177: Customer Drawing (090 MLC 10P CAP HSG)
- 368182 : Customer Drawing (090 MLC 14P PLUG HSG)
- 368181 : Customer Drawing (090 MLC 14P CAP HSG)
- 368184 : Customer Drawing (090 MLC 16P PLUG HSG)
- 368183 : Customer Drawing (090 MLC 16P CAP HSG)
- 368186 : Customer Drawing (090 MLC 18P PLUG)
- 368185 : Customer Drawing (090 MLC 18P CAP HSG)
- 368188 : Customer Drawing (090 MLC 20P PLUG HSG)
- 368187 : Customer Drawing (090 MLC 20P CAP HSG)
- 368190 : Customer Drawing (090 MLC 22P PLUG HSG)
- 368189 : Customer Drawing (090 MLC 22P CAP HSG)

## 3. REQUIREMENTS

### 3.1. Design and Construction

Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

### 3.2. Ratings

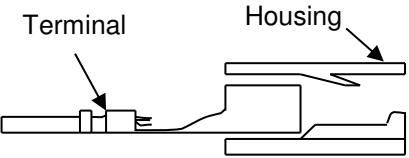
Voltage	Temperature	Humidity
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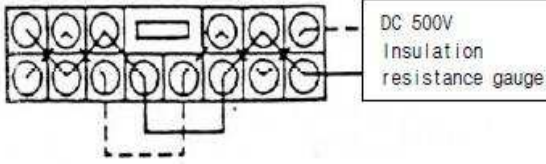
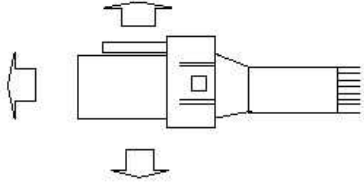
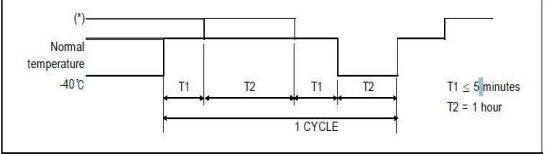
12V DC	25±5°C	65±20%
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### 3.3. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Appearance	No crack, damage, distortion are permitted	Using sense of sight and touch.
CONN engage and disengage force	8P, 10P 10kgf or less	Measure force by inserting and disengaging the connector with terminal assembled at constant 50 mm/min speed. However, remove lock part when measuring disengage force.
	14P, 16P, 18P, 20P, 22P 15kgf or less	
Reverse insertion between housings	It shall not be incorrectly inserted by applying force of 20kgf.	<ol style="list-style-type: none"> <li>1) Insert terminal to housing</li> <li>2) Fix housing of female connector to moving part of measuring instrument in reverse insertion direction. (Reverse insertion: 180 degree rotation on the locking part)</li> <li>3) Set a measuring instrument to stop at force of 20kgf and insert that. At this moment, monitor resistance of one terminal matched to identify current carrying between terminals.</li> <li>4) Check the insertion by housing modification of male connector after connector insertion.</li> </ol>
Reverse insertion between terminal and housing	5kgf or more	Crimp cable of maximum size on terminal and then insert it into housing by end of insulation barrel in the reserve direction.
Engage force between terminal and housing	Max 1.5kgf or less	<p>As shown in the following figure 4-1, measure the weight while inserting terminal into fixed housing at 50mm/min speed.</p>  <p>&lt;Figure 4-1&gt;</p>
CONN Clip panel engage and retention force	Engage: Max 12kgf or less Retention: Min 15kgf or more	<ol style="list-style-type: none"> <li>1. Insert clip into the fixed plate that can be furnished with clip at 50mm/min and measure the force at that time.</li> <li>2. Pull clip at 50mm.min and measure the force when destroyed or disengaged</li> </ol>
Strength of HSG lock	Min 10kgf or more	Combine housing only, fix the one side of housing in completely locked condition, and extend the other side in axial direction and 30 angle direction at a constant speed of 50mm/min. Then measure weight when lock structure is disengaged or destroyed.
HSG lock releasing force	Max 6kgf	Apply force (F) to lock releasing part, and measure weight on the point of A=0. However, cut connector and then perform

		test at the section in order to secure visibility.												
		<p>&lt;Figure 5-2&gt;</p>												
Terminal retention force	Min 10kgf	Fix the housing after inserting crimped terminals. Extend one line of cable in axial direction at a speed of 50mm/min at a position 50~100mm away from crimped part, and measure weight when terminal is disengaged from the housing.												
Terminal engage and disengage force (kgf)	Engage	0.3~1.0kgf												
	Disengage	0.15~1.0kgf												
Crimp strength (kgf)	0.5SQ: Min 9kgf or more 1.25SQ: Min 17kgf or more 2.0SQ: Min 20kgf or more	Fix the crimped terminal, and draw the cable at a position 50~100 mm away from crimped part in axial direction at 100 mm/min speed. Then measure the weight when cable is cut or disengaged from the crimped part												
Voltage Drop	090~375 : Max 3mV/A	<p>Measure the circuit voltage drop (V) by sending voltage and current described in the table 5-1 with terminal combined on the connector. Then calculate a voltage drop (VD) in terminal by subtracting cable resistance (L) from the circuit voltage drop (V).</p> <p>1) HARNESS versus UNIT: <math>VD = V(L3+L4)</math></p> <table border="1"> <thead> <tr> <th>Application</th> <th>Open voltage</th> <th>Short circuit current</th> <th>Division</th> </tr> </thead> <tbody> <tr> <td>Signal circuit</td> <td><math>20 \pm 5</math> mV</td> <td>10 mA</td> <td>ECU, Sensor</td> </tr> <tr> <td>Power circuit</td> <td>13 V</td> <td>1 A</td> <td>Other than the above</td> </tr> </tbody> </table> <p>&lt;Table5-1&gt;</p>	Application	Open voltage	Short circuit current	Division	Signal circuit	$20 \pm 5$ mV	10 mA	ECU, Sensor	Power circuit	13 V	1 A	Other than the above
Application	Open voltage	Short circuit current	Division											
Signal circuit	$20 \pm 5$ mV	10 mA	ECU, Sensor											
Power circuit	13 V	1 A	Other than the above											
Insulation resistance	Min 100 MΩ	<p>Measure resistance between neighbor terminals (figure 5-6), and between terminal and housing surface (figure 5-7) with DC 500V insulation resistance gauge with connector combined.</p> <p>&lt;Figure 5-6: Between neighboring terminals&gt;      &lt;Figure 5-7: Between neighboring terminal and housing surface&gt;</p>												
Leakage current	10 μA or less	Measure it by applying DC 14V between neighboring terminals (figure 5-6).												

				 <p>&lt;Figure 5-6: Between neighboring terminals&gt;</p>						
High voltage test	No allowed insulation breakdown			Measured by applying test potential of 1000 V AC between the adjacent contact between the contact and housing.						
Twisting Test - Connector Engage and Disengage Endurance Test	Appearance	No crack, damage, distortion are permitted		Apply 8kgf force on the end part of combined connector 10 times each in the (front, rear, left, right) directions perpendicular to axial direction.						
		Max 10mV/A		Make combine connectors engage and disengage at 100mm/min. Perform it 50 times. (Do not use locking device)						
Overcurrent cycle test	Appearance	No crack, damage distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and apply the following current 1000 cycles for the connector with electrodes in series at 60 °C of ambient temperature.						
	Voltage Drop	Max 10mV/A	Condition A	<table border="1" data-bbox="787 898 1421 955"> <tr> <td>Current application condition A</td> <td>Applied current</td> <td>2 times of basic current</td> </tr> <tr> <td></td> <td>Current application time</td> <td>1 minute - ON, 9 minutes - OFF</td> </tr> </table>	Current application condition A	Applied current	2 times of basic current		Current application time	1 minute - ON, 9 minutes - OFF
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Condition B	<table border="1" data-bbox="787 961 1421 1018"> <tr> <td>Current application condition B</td> <td>Applied current</td> <td>5 times of basic current</td> </tr> <tr> <td></td> <td>Current application time</td> <td>10 seconds - ON, 590 seconds - OFF</td> </tr> </table>	Current application condition B	Applied current	5 times of basic current		Current application time	10 seconds - ON, 590 seconds - OFF			
Current application condition B	Applied current	5 times of basic current								
	Current application time	10 seconds - ON, 590 seconds - OFF								
Temp rise	Max 40°C	Condition A	Condition b							
Cold temperature test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and leave it in temperature chamber of -40°C for 120 hours. Make connector engaged and disengaged 5 times immediately, and drop it onto the concrete surface from 1m height 3 times in the direction of figure 6-1. (Voltage drop & Temperature rise test perform at normal temperature) :						
	Insulation Resistance	Min 10 kΩ	Between terminals							
	Current Leakage	Max 1mA	housing surface							
				 <p>&lt;Figure 6-1&gt;</p>						
Cold and hot temperature shock test	Appearance	No crack, damage, distortion are permitted		Engage and disengage Connector with terminal assembled 10 times with hands, this repeats 200 CYCLE by below test condition. ( Non-Sealed : 80°C)						
	Voltage Drop	Max 10mV/A								

High temperature test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and leave it in combined state at the temperature chamber of the table 6-1 for 300 hours. Then pick it out and leave it until it returns to normal temperature.	
	Voltage Drop	Max 10mV/A			
Temperature Humidity Test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and leave it at 25°C ambient temperature and 65% relative humidity for 25 hours. And perform 5 cycles of the method specified in figure 6-3. Then pick connector out of chamber and dry it for 2 hours or more.	
	Voltage Drop	Max 10mV/A			
	Insulation Resistance	Min 10 kΩ	Between terminals		housing surface
			Current Leakage		
				<p>&lt; Figure 6-3 : Test pattern &gt;</p>	
Dust Test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and diffuse 1.5kg Portland cement(JIS R5210) with fan (or others) for 10 seconds per 15 minutes while maintaining 150mm distance from wall in the closed container of 900~1200mm length, width and height, with connector combined. After 1 hour, measure it.	
	Voltage Drop	Max 10mV/A			
Oil and liquid test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and perform test each sample with connector combined. A. Immerse connector in combined state for 2 hours in mixed oil of 50± 2°C ENG oil (SAE10W) or equivalent oil and B. Immerse connector in combined state for 1 hour in car gasoline (JIS K2202) at normal temperature, and then pick it out. C. Immerse connector in combined state for 1 hour in brake liquid (pure product) at normal temperature, and then pick it out. D. Immerse connector in combined state for 1 hour in 100% washer liquid (pure product) at normal temperature, and then pick it out. E. Immerse connector in combined state for 1 hour in 50% LLC (Long life coolant) at normal temperature, and then pick it out.	
	Voltage Drop	Max 10mV/A			
Ozone Test	Appearance	No crack, damage, distortion are permitted		Engage and disengage Connector with terminal assembled 10 times with hands, and samples keep at 40°C and 50±5pphm Ozone for 100hour. Then pick connector out of chamber and dry it for 2hours or more	
	Voltage Drop	Max 10mv/A			
Sulfur (SO <sub>2</sub> ) gas test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and expose it in combined state to sulfur gas	

	Voltage Drop	Max 10mV/A		of 40±3°C, density 10ppm, humidity 90~95%, for 24 hours. Then pick connector out of chamber and dry it for 2 hours or more.																
Complex environment endurance test	Appearance	No crack, damage, distortion are permitted		Engage and disengage connector with terminal assembled 10 times with hands, and leave it in combined state in the temperature chamber of 120°C or 80°C (follows table 7) for 48 hours.																
	Crimp Tensile Strength	0.5SQ	Min 9kgf		And then perform the following vibration test. Then measure instant short circuit according to the method of clause 4.16 for 4 hours for X, Y, Z each. 1) Sin Wave Test															
		1.25SQ	Min 17kgf																	
		2.0SQ	Min 20kgf																	
	Voltage Drop	Max 10mV/A		<table border="1"> <thead> <tr> <th>Division</th> <th>Condition</th> </tr> </thead> <tbody> <tr> <td>Ambient temperature/humidity</td> <td>Refer to figure 4-8, 90~95%</td> </tr> <tr> <td>Applied current</td> <td>Basic current (Connector electrodes in series.)</td> </tr> <tr> <td>Current application cycle</td> <td>120 CYCLE (45 minutes-ON, 15 minutes-OFF)</td> </tr> <tr> <td>Vibration acceleration</td> <td>4.4G</td> </tr> <tr> <td>Frequency</td> <td>20Hz ~ 200Hz (sweep time: 3 minutes or less)</td> </tr> <tr> <td>Vibration time</td> <td>40 hours for X, Y, Z each</td> </tr> <tr> <td>Connector attaching method</td> <td>Test mode A, B, C</td> </tr> </tbody> </table>	Division	Condition	Ambient temperature/humidity	Refer to figure 4-8, 90~95%	Applied current	Basic current (Connector electrodes in series.)	Current application cycle	120 CYCLE (45 minutes-ON, 15 minutes-OFF)	Vibration acceleration	4.4G	Frequency	20Hz ~ 200Hz (sweep time: 3 minutes or less)	Vibration time	40 hours for X, Y, Z each	Connector attaching method	Test mode A, B, C
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Vibration time	40 hours for X, Y, Z each																			
Connector attaching method	Test mode A, B, C																			
Temperature Rise	Max 40°C																			
Instant short circuit	Max 10 $\mu$ S																			

3.4. Applied Part No List

TE Part no	Description
1-368175-1	090 MLC 8P CAP HSG
1-368176-1	090 MLC 8P PLUG HSG
1-368178-1/3	090 MLC 10P PLUG HSG
1-368177-1	090 MLC 10P CAP HSG
0-368182-1 1-368182-1	090 MLC 14P PLUG HSG
1-368181-1	090 MLC 14P CAP HSG
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